Cortical masking and action learning

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Cortical Masking and Action Learning

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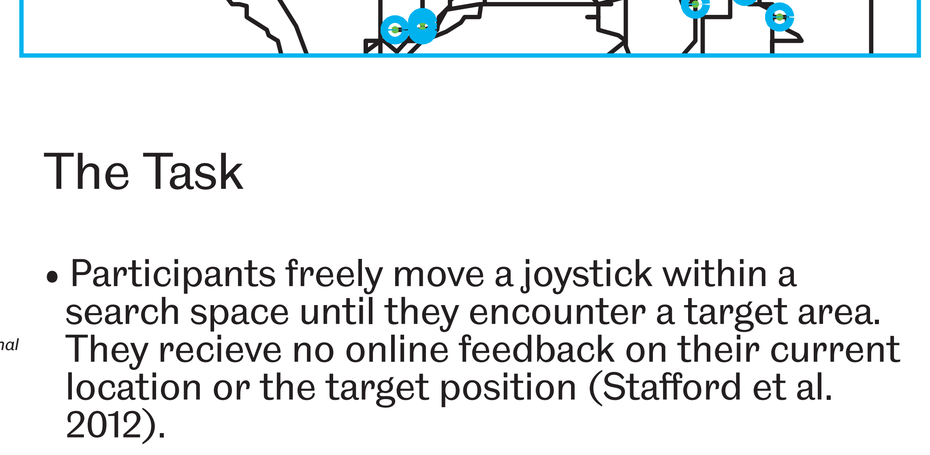
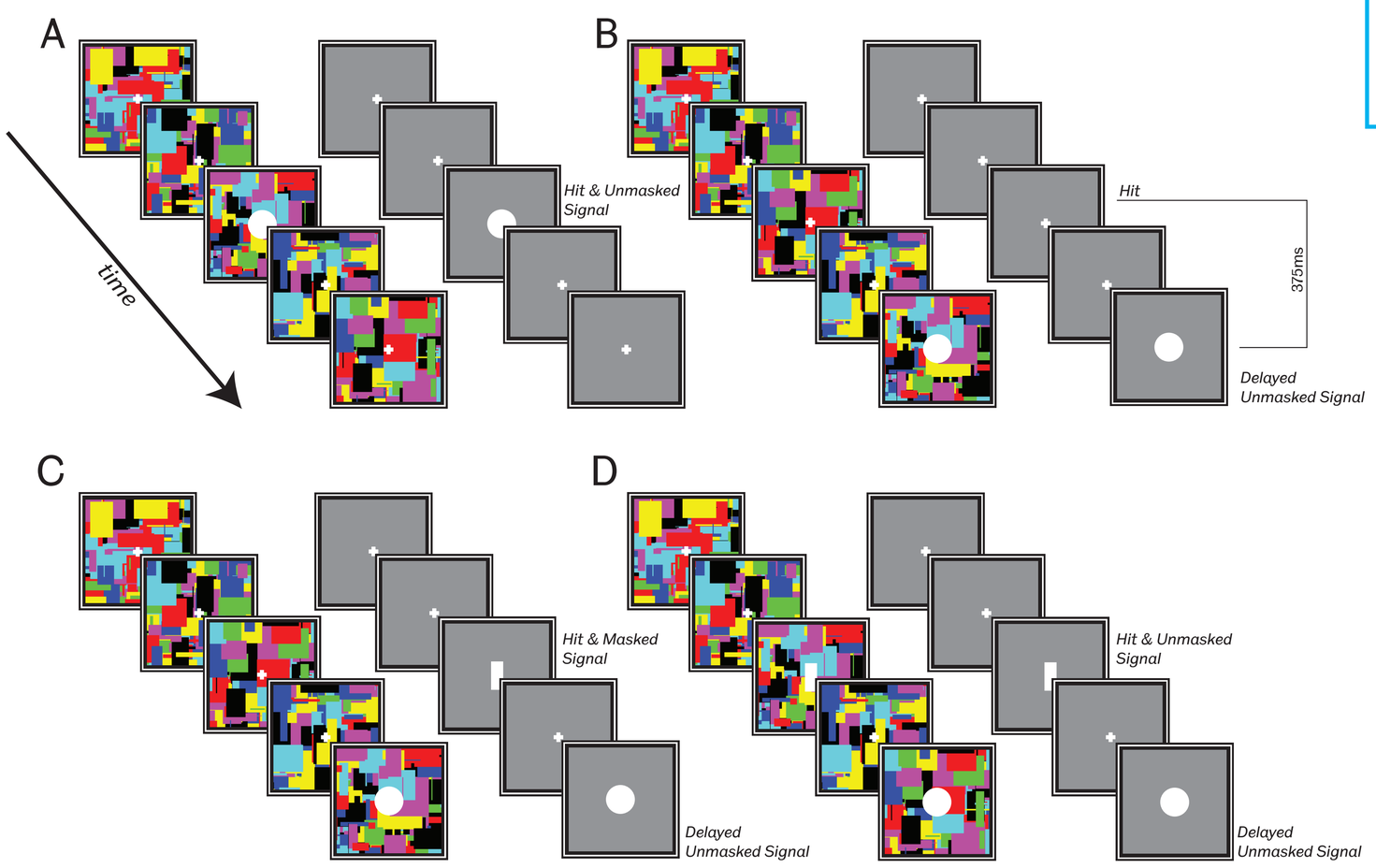
Introduction

- Action outcome learning requires the pairing of an external event with behavioural output.
- The basal ganglia (BG) are thought to be crucial for the pairing of recent motor output with an unexpected visual stimulus (Redgrave & Gurney 2006).
- Previous work (Thirkettle et al 2011) has shown that subcortical visual input is preferred to information which must arrive at the BG via the cortex.
- However, it remains to be seen if subcortical processing is sufficient for action-outcome learning, and what, if any, contribution the results of cortical processing make.



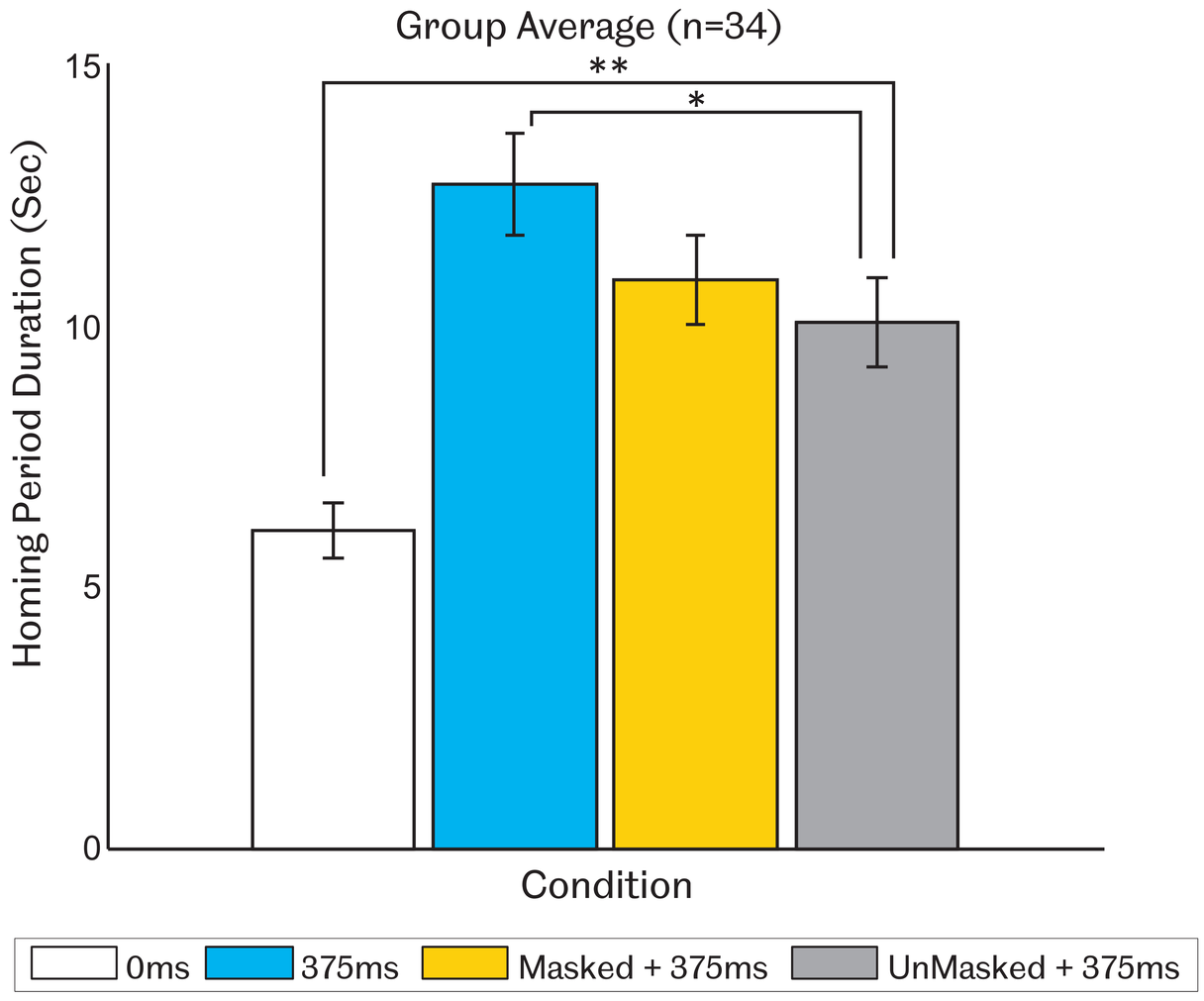


The Task

- Participants freely move a joystick within a search space until they encounter a target area. They recieve no online feedback on their current location or the target position (Stafford et al. 2012).
- Hitting the target results in an on screen reinforcing signal which participants then use to guide their behaviour, homing in on and then holding the joystick on the target.
- Constant Flash Suppression (Tsuchiya, & Koch, 2005) masking was used to prevent cortical processing of an immediate reinforcing signal. This was then followed by an unmasked, but delayed, signal.
- If cortical processing contributes to action outcome learning, then performance should be better with an unmasked immediate signal (condition D) than with a masked immediate signal (condition C).

Methods

- Participants wore prism glasses and viewed a dichoptic display with a mask presented to their dominant eye (Mondrians changing at 10Hz).
- Reinforcing signals were presented
  - to the masked eye only (`masked') or binocularly (`unmasked')
  - immediately upon hit and/or after a 375ms delay (delayed always unmasked).
- Performance was measured as the average time between first target encounter and settling on the target location (the homing period).



Results / Conclusions

- Action outcome learning is significantly impaired by delaying reinforcing signal presentation.
- Performance with both an immediate and a delayed signal (Conditions C &D) is between that found with each independently (A & B), suggesting that the two signals are used in combination.
- No significant difference found between performance with cortically masked (C) and cortically available (D) immediate signals
- Lack of significant difference between masked immediate signal and delayed only (B & C) may suggest the mask is too effective, future experiments will investigate this.
- Current results show no evidence that cortical processing has any role in action outcome learning when subcortical input is

References

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